We claim:

1. An apparatus integrating forward and panoramic fields, comprising:

a primary reflector, comprising a convex surface in relation to the forward field, reflective on at least part of said convex surface;

a secondary reflector, forward of said primary reflector relative to said forward field, reflective on at least part a surface thereof facing rearward toward said primary reflector;

a primary reflector hole in said primary reflector, substantially centered about an optical axis of said apparatus; and

a secondary reflector hole in said secondary reflector, substantially centered about said optical axis.

2. The apparatus of claim 1, further comprising:

at least one field collecting element, forward of said secondary reflector relative to said forward field, substantially centered about said optical axis.

3. The apparatus of claim 2:

said at least one field collecting element comprising at least two field collecting elements, with at least one of said field collecting elements movable along said optical axis.

4. The apparatus of claim 1, further comprising:

at least one field focusing element, rearward of said primary reflector relative to said forward field, substantially centered about said optical axis.

5. The apparatus of claim 1, further comprising:

at least one afocal element, rearward of said primary reflector relative to said forward field, substantially centered about said optical axis.

6. The apparatus of claim 1, further comprising:

at least one field collecting element, forward of said secondary reflector relative to said forward field, substantially centered about said optical axis; and

at least one field focusing element, rearward of said primary reflector relative to said forward field, substantially centered about said optical axis.

7. The apparatus of claim 6, wherein:

said primary reflector, said secondary reflector, at least one field collecting element and said at least one field focusing element are configured, in combination, to project a substantially seamless boundary between said forward and panoramic fields onto a detection plane.

8. The apparatus of claim 6, further comprising:

a detector substantially in a focal plane of said at least one field focusing element.

9. The apparatus of claim 8, said detector comprising an optical detector.

10. The apparatus of claim 8, said detector comprising an infrared detector.

11. The apparatus of claim 8, said detector comprising an detector for communications waves.

12. The apparatus of claim 1:

said convex surface of said primary reflector comprising a substantially spherical geometry.

13. The apparatus of claim 1:

said convex surface of said primary reflector comprising a substantially hyperbolic geometry.

14. The apparatus of claim 1:

said convex surface of said primary reflector comprising a substantially parabolic geometry.

15. The apparatus of claim 1, wherein a diameter of said secondary reflector hole is larger than a diameter of said primary reflector hole.

16. The apparatus of claim 1, said secondary reflector comprising a substantially flat geometry facing rearward toward said primary reflector.

17. The apparatus of claim 1, said secondary reflector comprising a concave geometry facing rearward toward said primary reflector.

18. The apparatus of claim 1, said secondary reflector comprising a convex geometry facing rearward toward said primary reflector.

19. The apparatus of claim 1, wherein said primary reflector can be tilted relative to said optical axis.

20. The apparatus of claim 1, wherein said forward and panoramic fields comprise optical fields in the visible light spectrum.

21. The apparatus of claim 1, wherein said forward and panoramic fields comprise optical fields in the infrared light spectrum.

22. The apparatus of claim 1, wherein said forward and panoramic fields comprise electromagnetic waves.

23. The apparatus of claim 1, wherein said forward and panoramic fields comprise electromagnetic waves traveling in free space for communication.

24. A method for receiving signals with integrated forward and panoramic fields, comprising:

providing a primary reflector, comprising a convex surface in relation to the forward field, reflective on at least part of said convex surface;

facing a secondary reflector, forward of said primary reflector relative to said forward field, reflective on at least part a surface thereof, rearward toward said primary reflector;

substantially centering a primary reflector hole in said primary reflector, about an optical axis of said primary reflector and said secondary reflector; and

substantially centering a secondary reflector hole in said secondary reflector, about said optical axis.

25. The method of claim 24, further comprising:

substantially centering at least one field collecting element, forward of said secondary reflector relative to said forward field, about said optical axis.

26. The method of claim 25, wherein said at least one field collecting element comprises at least two field collecting elements, further comprising:

moving at least one of said field collecting elements along said optical axis.

27. The method of claim 24, further comprising:

substantially centering at least one field focusing element, rearward of said primary reflector relative to said forward field, about said optical axis.

28. The method of claim 24, further comprising:

substantially centering at least one afocal element, rearward of said primary reflector relative to said forward field, about said optical axis.

29. The method of claim 24, further comprising:

substantially centering at least one field collecting element, forward of said secondary reflector relative to said forward field, about said optical axis; and

substantially centering at least one field focusing element, rearward of said primary reflector relative to said forward field, about said optical axis.

30. The apparatus of claim 29, further comprising:

configuring said primary reflector, said secondary reflector, at least one field collecting element and said at least one field focusing element are, in combination, to project a substantially seamless boundary between said forward and panoramic fields onto a detection plane.

31. The method of claim 29, further comprising:
providing a detector substantially in a focal plane of said at least one field focusing element.

32. The method of claim 31, said detector comprising an optical detector.

33. The method of claim 31, said detector comprising an infrared detector.

34. The apparatus of claim 8, said detector comprising an detector for communications waves.

35. The method of claim 24:
said convex surface of said primary reflector comprising a substantially spherical geometry.

36. The method of claim 24:
said convex surface of said primary reflector comprising a substantially hyperbolic geometry.

37. The method of claim 24:
said convex surface of said primary reflector comprising a substantially parabolic geometry.

38. The method of claim 24, wherein a diameter of said secondary reflector hole is larger than a diameter of said primary reflector hole.

39. The method of claim 24, further comprising:
facing a substantially flat geometry of said secondary reflector rearward toward said primary reflector.

40. The method of claim 24, further comprising:
facing a concave geometry of said secondary reflector rearward toward said primary reflector.

41. The method of claim 24, further comprising:
facing a convex geometry of said secondary reflector rearward toward said primary reflector.

42. The method of claim 24, further comprising:
tilting said primary reflector relative to said optical axis.

43. The apparatus of claim 24, said receiving further comprising:
receiving optical fields in the visible light spectrum.

44. The apparatus of claim 24, said receiving further comprising:
receiving optical fields in the infrared light spectrum.

45. The apparatus of claim 24, said receiving further comprising:
receiving electromagnetic waves.

46. The apparatus of claim 24, said receiving further comprising:
communicating through free space by receiving electromagnetic waves.

AMENDED CLAIMS

received by the International Bureau on 01 August 2005 (01.08.05): original claims 1-46 have been replaced by amended claims 1-44 (4 pages).

+ STATEMENT

We claim:

1. An apparatus integrating forward and panoramic fields, comprising:

a primary reflector, comprising a convex surface in relation to the forward field, reflective on at least part of said convex surface;

a secondary reflector, forward of said primary reflector relative to said forward field, reflective on at least part a surface thereof facing rearward toward said primary reflector, comprising a substantially flat geometry facing rearward toward said primary reflector;

a primary reflector hole in said primary reflector, substantially centered about an optical axis of said apparatus; and

a secondary reflector hole in said secondary reflector, substantially centered about said optical axis, said secondary reflector hole comprising a diameter smaller than a diameter of said primary reflector hole.

2. The apparatus of claim 1, further comprising:

at least one field collecting element, forward of said secondary reflector relative to said forward field, substantially centered about said optical axis.

3. The apparatus of claim 2:

said at least one field collecting element comprising at least two field collecting elements, with at least one of said field collecting elements movable along said optical axis.

4 The apparatus of claim 1, further comprising:

at least one field focusing element, rearward of said primary reflector relative to said forward field, substantially centered about said optical axis.

5. The apparatus of claim 1, further comprising:

at least one afocal element, rearward of said primary reflector relative to said forward field, substantially centered about said optical axis.

6. The apparatus of claim 1, further comprising:

at least one field collecting element, forward of said secondary reflector relative to said forward field, substantially centered about said optical axis, and

at least one field focusing element, rearward of said primary reflector relative to said forward field, substantially centered about said optical axis.

7. The apparatus of claim 6, wherein:

said primary reflector, said secondary reflector, at least one field collecting element and said at least one field focusing element are configured, in combination, to project a substantially seamless boundary between said forward and panoramic fields onto a detection plane.

8. The apparatus of claim 6, further comprising:

a detector substantially in a focal plane of said at least one field focusing element.

9 The apparatus of claim 8, said detector comprising an optical detector.

10. The apparatus of claim 8, said detector comprising an infrared detector.

11. The apparatus of claim 8, said detector comprising an detector for communications waves.

12. The apparatus of claim 1:

said convex surface of said primary reflector comprising a substantially spherical geometry.

13. The apparatus of claim 1:

said convex surface of said primary reflector comprising a substantially hyperbolic geometry.

14. The apparatus of claim 1:

said convex surface of said primary reflector comprising a substantially parabolic geometry.

15. The apparatus of claim 1, said secondary reflector comprising a concave geometry facing rearward toward said primary reflector.

16. The apparatus of claim 1, said secondary reflector comprising a convex geometry facing rearward toward said primary reflector.

17. The apparatus of claim 1, wherein said primary reflector can be tilted relative to said optical axis.

18. The apparatus of claim 1, wherein said forward and panoramic fields comprise optical fields in the visible light spectrum.

19. The apparatus of claim 1, wherein said forward and panoramic fields comprise optical fields in the infrared light spectrum.

20. The apparatus of claim 1, wherein said forward and panoramic fields comprise electromagnetic waves.

21. The apparatus of claim 1, wherein said forward and panoramic fields comprise electromagnetic waves traveling in free space for communication.

22. A method for receiving signals with integrated forward and panoramic fields, comprising:

providing a primary reflector, comprising a convex surface in relation to the forward field, reflective on at least part of said convex surface;

facing a substantially flat geometry of a secondary reflector, forward of said primary reflector relative to said forward field, reflective on at least part a surface thereof, rearward toward said primary reflector;

substantially centering a primary reflector hole in said primary reflector, about an optical axis of said primary reflector and said secondary reflector; and

substantially centering a secondary reflector hole in said secondary reflector, about said optical axis; wherein:

a diameter of said secondary reflector hole is smaller than a diameter of said primary reflector hole.

23. The method of claim 22, further comprising.

substantially centering at least one field collecting element, forward of said secondary reflector relative to said forward field, about said optical axis.

24. The method of claim 23, wherein said at least one field collecting element comprises at least two field collecting elements, further comprising:

moving at least one of said field collecting elements along said optical axis.

25. The method of claim 22, further comprising:

substantially centering at least one field focusing element, rearward of said primary reflector relative to said forward field, about said optical axis.

26. The method of claim 22, further comprising:

substantially centering at least one afocal element, rearward of said primary reflector relative to said forward field, about said optical axis.

27. The method of claim 22, further comprising:

substantially centering at least one field collecting element, forward of said secondary reflector relative to said forward field, about said optical axis; and

substantially centering at least one field focusing element, rearward of said primary reflector relative to said forward field, about said optical axis.

28. The apparatus of claim 27, further comprising:

configuring said primary reflector, said secondary reflector, at least one field collecting element and said at least one field focusing element are, in combination, to project a substantially seamless boundary between said forward and panoramic fields onto a detection plane.

29. The method of claim 27, further comprising:
providing a detector substantially in a focal plane of said at least one field focusing element.

30. The method of claim 29, said detector comprising an optical detector.

31. The method of claim 29, said detector comprising an infrared detector.

32 The apparatus of claim 8, said detector comprising an detector for communications waves.

33. The method of claim 22:
said convex surface of said primary reflector comprising a substantially spherical geometry.

34. The method of claim 22:
said convex surface of said primary reflector comprising a substantially hyperbolic geometry

35. The method of claim 22:
said convex surface of said primary reflector comprising a substantially parabolic geometry.

36. The method of claim 22, further comprising:
facing a concave geometry of said secondary reflector rearward toward said primary reflector.

37. The method of claim 22, further comprising:
facing a convex geometry of said secondary reflector rearward toward said primary reflector.

38. The method of claim 22, further comprising:
tilting said primary reflector relative to said optical axis.

39. The apparatus of claim 22, said receiving further comprising:
receiving optical fields in the visible light spectrum.

40. The apparatus of claim 22, said receiving further comprising:
receiving optical fields in the infrared light spectrum.

41. The apparatus of claim 22, said receiving further comprising:
receiving electromagnetic waves.

42. The apparatus of claim 22, said receiving further comprising:
communicating through free space by receiving electromagnetic waves.

43 An apparatus integrating forward and panoramic fields, comprising:

a primary reflector, comprising a convex surface in relation to the forward field, reflective on at least part of said convex surface;

a secondary reflector, forward of said primary reflector relative to said forward field, reflective on at least part a surface thereof facing rearward toward said primary reflector, comprising a substantially flat geometry facing rearward toward said primary reflector;

a primary reflector hole in said primary reflector, substantially centered about an optical axis of said apparatus; and

said secondary reflector comprising a diameter smaller than a diameter of said primary reflector.

44. A method for receiving signals with integrated forward and panoramic fields, comprising:

providing a primary reflector, comprising a convex surface in relation to the forward field, reflective on at least part of said convex surface;

facing a substantially flat geometry of a secondary reflector, forward of said primary reflector relative to said forward field, reflective on at least part a surface thereof, rearward toward said primary reflector;

substantially centering a primary reflector hole in said primary reflector, about an optical axis of said primary reflector and said secondary reflector; and

substantially centering a secondary reflector hole in said secondary reflector, about said optical axis; wherein:

a diameter of said secondary reflector is smaller than a diameter of said primary reflector.

Statement Under Article 19(1)

Independent claims 1 and 22, as amended, now specify a "substantially flat geometry" for the secondary reflector, facing "rearward toward said primary reflector." None of D1, D2, D4, D5, and D6 disclose or suggest or motivate a substantially flat secondary reflector, and – to the extent that one might perceive an analogy between the reflectors in these documents and the reflectors of applicants – it would be impossible for the inventions in those documents to work properly if the analogous reflectors were to be flat.

Additionally, independent claims 1 and 22, as amended, now specify the "secondary reflector hole" being of a "diameter" which is "smaller than a diameter of said primary reflector hole," see, for example, not limitation, applicants' Figures 1, 2, and 5 and the related discussion in the disclosure of the importance of relative hole size to achieve a "balance in the total field of view between the forward field of view **318** and the panoramic field of view **320**," page 5, lines 12-13, so as to "to project a substantially seamless boundary between said forward and panoramic fields onto a detection plane," claims 7 and (renumbered) 30.

New claims 43 and 44 specify the secondary reflector comprising a diameter "smaller than a diameter of said primary reflector," see again, for example, not limitation, applicants' Figures 1, 2, and 5, and the related discussion in the disclosure of the importance of relative size and geometry of the reflectors.

D3 consistently appears to require identical hole sizes in each reflector, and identical diameters for each reflector, in contrast to what applicants claim. The central purpose of applicant's invention is to match all of the key parameters such as hole size and reflector diameter in order "to project a substantially seamless boundary between said forward and panoramic fields onto a detection plane" as set forth in claims 7 and (renumbered) 30. D3 *does not achieve this*, and in fact, D3 spends a significant amount of space describing a "*discontinuity*" between the lateral and axial portions of the image i.e. field of view. (See, for example, page 18, line 22 - page 19, line 21.) That is, D3 plainly states that their device yields a *discontinuous* image. *That is a problem with D3 which applicants overcome.*

Examiner is misinterpreting Figure 1c in D3, and is incorrect in finding that claims 7 and 30 lack novelty and inventive step. The crossing of the dotted light path lines at the top of Figure 1c means that there will actually be an overlap or a gap (discontinuity) between the lateral and axial portions of the image at all distances outside of and within the illustrated circle, as D3 clearly admits. It is applicants' novel and inventive selection of relative hole sizes, diameters, and other parameters as stated in the disclosure, which allows a very desirable continuous field of view which the prior art is unable to achieve because it does not understand how to adjust these parameters to a continuous field of view.